FOUNDRY TRADE JOURNAL
Established 1902
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

Vol. 77 Thursday, October 25, 1945 No. 1523

A Cast Iron Peace

It was impressed upon the nation that the recent cataclysm was not a cast iron war. Those propagating this notion apparently forgot that it was impossible to construct engineering plant without castings. Thus the last six years has seen the ironfoundry patiently and unspectacularly turning out castings for machine tools, steelworks plant, including ingot moulds, components for marine and rail transport, for tanks and fighting ships, for army vehicles, and so forth. Then there was the production of grenades, bombs and the like by the million. Still it was not supposed to be a cast iron war! Then a similar story got around. The post-war era was to be one of light alloys and plastics, asbestos cement and a thousand and one things, but not cast iron. Now the dreamers are awake. The popular Press has discovered that the foundry is still essential to industrial revival. Cinderella has been transformed into a "bottleneck." Scarcely a day passes but we are forcibly reminded as to the urgency of the problem. Some users are so desperately in need of castings that they ask for our advice as to the *mise en marche* of an ironfoundry for their exclusive use. Other buyers are prepared to take the complete output of a jobbing foundry for four years, if only the owner will refuse work from all other customers. Inquiries are coming to us for thousands of repetition castings such as electric iron sole plates, sewing machine parts and so forth, from distracted buyers. A potential source of supply is the magnesium foundries, wherein a falling away of contracts is noticeable. Their conversion would not be too difficult. Moreover, they would be better placed than the firms wishing to construct or convert buildings and equip shops, for the former at least possess the nucleus of a staff plus, of course, most of the essential machinery.

The ironfoundry could register fairly good progress providing it possessed the necessary manpower. Both Mr. V. Jobson and Mr. Ambrose Firth stressed this in their recent addresses from the chair to the shareholders in their companies. At the moment, recruitment for the Services is, it is said, more than balancing the return of demobilised men. Moreover, those departing have become, in many cases, quite proficient, whilst those who replace them need re-training.

The ironfoundry industry—especially that section catering for the building trades—is doing its best to re-equip itself to play its full part in the re-housing of the population. It is now confirmed that 28 major schemes of mechanised production are in the various stages between sanction and near completion. Yet the man-in-the-street fails to realise that no house—be it temporary or permanent—is of much use without rainwater goods, main drainage, cooking and heating apparatus. In wartime, the ironfoundry industry, as indeed did the whole of the manufacturers of castings in no matter what metal, responded well to all pressure put upon it to supply the munitions of war. A similar response will be made towards the rehabilitation of the country and its industries, but to do this there must be a clear recognition in Governmental departments that despite all adverse propaganda this is for the next few years a cast iron peace. The major use of a Government department to the business man is to obtain its influence to get something done by a second one. It is a matter of sincere regret that the departments concerned with peaceful progress do not seem to carry the magisterial authority as did the Admiralty, the War Office and the Air Ministry under war conditions. Yet something of the kind is needed if a way is to be found through the existing *cul de sacs*. A peacetime priority system for the order of the importance of the industries might be a useful suggestion. It would at least be helpful in the intelligent tensioning of the strings necessary to pull to get something done.

THE BROKEN HILL PROPRIETARY COMPANY, LIMITED, is to construct a new battery of 48 coke ovens at Port Kembla.

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FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

OCTOBER 27.

Newport and District Metallurgical Society :—"Slag Control in Basic Open-hearth Steel Making," by N. H. Bacon. At Newport Technical College, at 6.30 p.m.

OCTOBER 30.

Institute of Welding :—"The Fabrication of Aircraft Fuel Tanks in Aluminium Alloy Containing 3 per cent. Magnesium," by W. K. B. Marshall. At the Grand Hotel, Birmingham, 3, at 7 p.m.

OCTOBER 31.

Institute of Welding (Wolverhampton branch) :—Visit to works of Thompson Bros., Limited, Bilston.

NOVEMBER 1.

Institute of Welding (N.E. Tees-side branch) :—"The Reclamation and Repair of Rolling Mill Rolls," by E. Ryalls. At the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.15 p.m.

Institute of Welding (Portsmouth branch) :—"Progress in the Application of Welding to Shipbuilding," by W. G. John. At the Gas Company's offices, Guildhall Square, Portsmouth, at 7 p.m.

NOVEMBER 2.

Institute of Welding (South London branch) :—"Some Thoughts on the Weldability of Alloy Steels," by H. W. G. Hynett. At the Borough Polytechnic, Borough Road, London, S.E.1, at 7.30 p.m.

NOVEMBER 3.

Institute of Welding (Leeds branch) :—"Fabrication Design for Machine Tools," by F. Koenigsberger. At the Technical College, Hoowood Lane, Halifax, at 3 p.m.

NOVEMBER 5.

Association of Bronze and Brass Founders :—Lancashire and Cheshire area meeting. At the Midland Hotel, Manchester, at 2.30 p.m.

NOVEMBER 7.

Scottish Engineering Students' Association :—"Photo Elasticity," by A. A. Wells. At the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, at 7.15 p.m.

NOVEMBER 12.

Association of Bronze and Brass Founders :—Yorkshire area meeting. At the Great Northern Hotel, Leeds, at 12.30 p.m.

NOVEMBER 15.

Association of Bronze and Brass Founders :—Midland area meeting. At the Station Hotel, Stoke-on-Trent, at 1 p.m.

Institute of British Foundrymen

OCTOBER 26.

Falkirk section :—Informal discussion on foundry mechanisation, to be replied to by Mr. J. W. Gardom, president of the Institute. At the Temperance Café, Lint Riggs, Falkirk, at 7 p.m.

OCTOBER 27.

Bristol and West of England branch :—"Duplex Pump Castings," by Brown and Dewhurst. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

East Midlands branch :—"The Quick Immersion Pyrometer in the Cast-iron Foundry," by R. C. Tucker. At Loughborough College, at 6 p.m.

OCTOBER 31.

London branch :—"The Application of Ethyl Silicate to Foundry Practice," by C. Shaw. Demonstrated by N. Shaw. Joint meeting with the Institute of Metals. At the Royal Institution, 121, Albemarle Street, London, W.1, at 7.30 p.m.

NOTES FROM THE BRANCHES

FALKIRK SECTION—At the opening meeting of the session held recently at the Temperance Café, Falkirk, Mr. Ronald Taylor presided over a good attendance. After the formal business had been transacted, Mr. Taylor called on Mr. Thomas R. Goodwin to assume the presidency for the ensuing session. Mr. Goodwin, after thanking the members for the honour which they had conferred on him, asked that questions be submitted on "Mechanisation with Respect to the Light Castings Industry," as they were to have a visit from Mr. John Gardom, president of the Institute, on the occasion of the next meeting. Mr. Gardom had asked that the meeting take the form of a "one-man brains trust" rather than a Paper on this subject, so that members might obtain direct information on any aspect which was of particular interest to them.

Mr. R. R. Taylor, of Larbert, gave a fine descriptive talk on "Running Systems for Light Engineering Castings." Many methods were described and illustrated by lantern slides, and reasons were advanced for their application to the various jobs. Figures were available to the smallest detail for all the castings described. Throughout the talk, Mr. Taylor was ably assisted by Mr. David Fleming, of Falkirk, one of the younger members of the section, and whose work in the preparation of the Paper was appropriately acknowledged. At the conclusion of the talk, the chairman paid tribute to is value, and to the painstaking work entailed in its preparation. The meeting was then opened to discussion which was mainly concerned with the design and use of pencil gates and slag traps. Full information and guidance were given on the matter in illustrations by Mr. Taylor.

WALES AND MONMOUTH—The first meeting of the session was held recently when, by the courtesy of the directors of Brown, Lenox & Company, Limited, Pontypridd, members visited this old-established chain works and steel foundry. The party was welcomed by Mr. R. J. Richardson and Mr. Kelly, branch-president. Great interest was shown in the processes entailed in the production of cast-steel cables and chains, particularly in the construction of moulds with oil-sand cores. The tour was timed to return to see the electric furnace tapped and a row of moulds cast. The company adjourned to the works canteen, where, following tea, they heard a talk on "The Production of Steel Castings" by Mr. J. E. Mercer, of Middlesbrough, who outlined the production of steel castings over the past 40 years, including crucible melting, tropenas and electric furnace. Moulding technique in detail was fully explained and profusely illustrated with a series of lantern slides to an attentive audience. Numerous questions were forthcoming, all of which were dealt with by the lecturer.

Mr. R. J. Richardson proposed a vote of thanks to Mr. Mercer for his effort in travelling to South Wales and giving so comprehensive a description of the whole art of steel founding, which he was sure every member present had greatly appreciated. Mr. Gordon Rees seconded, and the motion was carried with enthusiasm.

THE CAUSE AND CONTROL OF MICROPOROSITY IN MAGNESIUM ALLOYS*

Comparative tests made on aluminium base alloys of similar constitution

By E. A. G. LIDDIARD, M.A., and W. A. BAKER, B.Sc.

SYNOPSIS

The form and distribution of porosity in magnesium base alloy castings solidified under controlled conditions have been studied and some comparative tests made on aluminium base alloys of similar constitution. It is concluded (1) *that the characteristic microporosity in magnesium alloys is due essentially to unfed shrinkage in alloys which solidify over a temperature range;* (2) *that the presence of gas in magnesium base alloys causes a marked increase in the amount of microporosity in the casting and does not alter its characteristic form;* (3) *that owing to their low heat capacity and relatively rapid solidification the temperature distribution in many magnesium alloy castings tends to be less favourable to progressive feeding; and* (4) *that under the same solidification conditions, the strength of unfed castings in magnesium and aluminium alloys is affected to the same extent, but that it is more difficult to ensure correct solidification conditions in magnesium than in aluminium alloys.*

Foundry technique must be such that the metal is free from gas initially and does not pick up gas by reaction with overheated sand. Running, pouring and gating conditions must be adjusted to ensure progressive solidification from the important parts of the casting towards the risers and feeders.

One of the principal difficulties encountered in making castings in magnesium alloys is the occurrence of a fine form of porosity known as microporosity, and the British Non-Ferrous Metals Research Association has carried out an extensive research to determine the causes and methods of controlling microporosity in magnesium alloy castings. The following Paper gives an outline of the results so far obtained. Fuller details of the experimental work are given in a Paper by W. A. Baker which has been submitted to the "Journal of the Institute of Metals."

General Lines of Investigation

The investigation has been mainly concerned with sand castings. Castings have been made in various alloys of magnesium using test castings of different forms. The broad lines of investigation are dealt with below:—

1. *Metals Used.*—All alloys were prepared from pure commercial material including 99.8 per cent. purity magnesium, 99.99+ per cent. or 99.5 per cent. purity aluminium, 99.99+ per cent. zinc, 99.8 per cent. nickel (pellets). Where other constituents were added these were also of the highest purity obtainable.

2. *Melting.*—Alloys were melted in iron crucibles, covered during melting with Melrasal flux Z, and refined by stirring at a temperature of 700 to 750 deg. C. with Melrasal flux E. Except where otherwise stated, the alloys were superheated to a temperature of 250 deg. C. above the liquidus temperature, that is to say, to about 850 to 900 deg. C. for most alloys. During the superheating the alloys were protected with Melrasal flux E. Gas-melting furnaces were used for most of the work.

3. *Mould Materials.*—Unless otherwise stated the alloys were cast in a highly permeable silica sand mixture containing 6 per cent. sulphur, 0.5 per cent. boric acid, 4 per cent. bentonite or 5 per cent. Fulbond No. 1 and 2-2.5 per cent. of water.

4. *Types of Castings Used.*—Several different castings were used; the main types are illustrated in Fig. 1, although some alterations were made in the dimensions during the work.

(*a*) DTD type bars which in general gave specimens free from porosity whose properties formed a standard for comparison purposes.

(*b*) A top-run bar with feeder of varying size generally too small to give complete feeding.

(*c*) A bottom-run vertical bar with a feeder head at the top, termed a conventional bar.

(*d*) A bottom-run, bottom-fed bar, termed an inverted bar.

(*e*) A bottom-run bulged bar of either circular or rectangular cross-section with or without a feeder head at the top.

(*f*) A hot-tear test casting in which horizontally cast bars were cast round small insert bolts, which were secured to the moulding flask by means of a nut. The nut could be slackened back to vary the degree of restraint applied to the bar during solidification.

(*g*) A pressure-disc casting. A flat disc with a central boss tested up to 200 lb. per sq. in. air pressure in machined and unmachined condition.

Except for the DTD bar, all the above castings were not fully fed, and were designed to study the

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* Paper read at the 42nd annual meeting of the Institute of British Foundrymen, held in London on June 15 and 16, 1945. The Authors are respectively Research Manager and Investigator of the British Non-Ferrous Metals Research Association.

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effects of varying distribution of shrinkage porosity. A few castings were also made in chill moulds, which were lowered into molten lead-tin alloys held at a controlled temperature.

5. *Methods of Examination.*—The castings produced were examined in the following ways:—

(*a*) DENSITY.—The densities of the castings or sections cut from castings were determined from which the proportion of voids in the metal could be calculated. The specific gravity of a casting that had not been properly fed was compared with that of a DTD bar. That the DTD bars usually gave the maximum density of the alloys was proved by microscopic examination, which showed them to be free from porosity, and by the fact that the densities were the same as those of sound chill-cast blocks.

(*b*) MECHANICAL TESTS.—Test-pieces were cut from various parts of the castings and tested in tension to

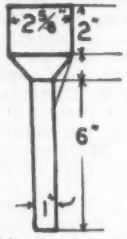

FIG. 1(*a*).—DTD BAR. POURED INCLINED 30 DEG. TO VERTICAL AND LEFT IN THAT POSITION.

show the effect of a given amount of porosity on the strength of the material. The strengths were expressed as percentages of those of sound DTD bars poured from the same melt.

(*c*) X-RAY EXAMINATION.—Most of the castings were radiographed, from which the occurrence of streaks of porosity, or localised patches of porosity, could be seen.

(*d*) MICROGRAPHIC EXAMINATION.—Microsections were prepared from various portions of the casting. These served to show the form and distribution of porosity.

The Form and Distribution of Porosity in Magnesium Alloys

The form of porosity met with in magnesium-base alloys differs in certain respects from that normally found in other cast metals, and the following terms are used throughout this Paper to define particular types of porosity.

1. *Microporosity.*—This means finely distributed porosity occurring round the grain boundaries. Typical examples are shown in Figs. 2 and 3. This intercrystalline porosity is not, however, peculiar to magnesium-base alloys, although, since most magnesium alloys are finer grained than other cast materials, *e.g.*, aluminium-base alloys, the porosity is finer. As in many other non-ferrous alloys, intergranular or microporosity is shown up as discolorations on fractured castings. It is most pronounced on alloys fractured after heat-treatment, the colour varying from light straw to almost black.

2. *Layer Porosity.*—A particular form of porosity, peculiar to magnesium alloys, shows up on radiographs as dark streaks in sand castings (Fig. 4). Under the microscope these streaks show up as strings of porosity, as shown in Fig. 5. For want of a better

FIG. 1(*b*).—TOP-RUN BAR WITH FEEDER USUALLY TOO SMALL TO GIVE COMPLETE FEEDING. CAST IN INCLINED POSITION.

description, this type of porosity has been called layer porosity throughout the work, and means porosity appearing as small intercrystalline cavities in patches shallow in depth and of relatively large area. The layers are at right angles to the wall of sand castings. X-rays only reveal this porosity when the layers lie in the same plane as the X-ray beams. That is one of the reasons why in practice it is necessary to take a large number of X-ray shots in different directions, to be certain that any casting is free from layer porosity.

3. *Intense Concentrations of Porosity.*—A patch of porosity is often concentrated at one part of a casting. This form of porosity is common to most cast alloys, and it has the most serious effect on strength. In a radiograph it shows up as a formless mass of porosity and is independent of the direction of the X-ray beam. Fig. 6 is a photo-micrograph showing an intense concentration of porosity in a magnesium alloy. It commonly occurs in the last part of an unfed casting to solidify.

4. *Secondary Pipe.*—This takes the form of a single

cavity situated at the last part of the casting to solidify. It is found in materials which solidify with little or no freezing range, *i.e.*, pure metals and eutectic alloys. A typical example of a secondary pipe in a eutectic aluminium-magnesium alloy is shown in Fig. 7.

5. *Annular Porosity.*—This is a defect which appears to be much more pronounced in magnesium-base alloys than in others. It appears in cylindrical chill castings in which an annulus of porosity is found at a distance from the chill face. The external skin

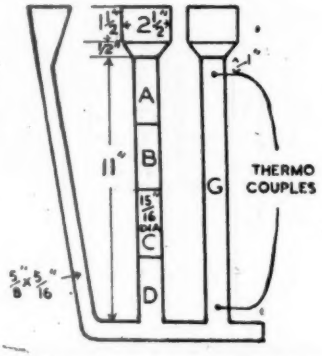

FIG. 1(*c*).—BOTTOM-RUN VERTICAL BAR. ROUND-SECTION PARALLEL BARS, TOP-FED, SHOWING LOCATION OF COUPLES AND POSITION OF A, B, C, D, G BARS. SIMILAR BARS WERE MADE WITHOUT FEEDERS, BUT WITH 1-IN. DIA. DOWNGATE AND RUNNER AND POURED AT CONTROLLED RATE THROUGH A BUSH.

Effect of Gas

of the chill casting is perfectly sound and the internal portion is relatively sound. In many cases the annulus of porosity is resolved into a large number of adjacent small layers normal to the mould wall. A similar type of porosity is also seen in sand castings poured at low temperatures.

When gas is given off from a metal during solidification, some is almost invariably trapped inside the casting, where it forms cavities. When the gas comes off while most of the metal is still liquid, the cavities tend to be spheroidal, since the pressure of the gas is greater than that of the atmosphere and the head of still liquid metal, but if most of the metal has solidified before the gas comes off, it will force the still liquid metal from between the dendrites that have solidified. In the complete absence of gas a shrinkage cavity would be a vacuum, and hence even the smallest amount of gas allows cavities to form more easily as a result of the shrinkage of the solidifying metal. It follows that there is no sharp distinction between gas and shrinkage cavities, and it is impossible by merely looking at a cavity between the grains of a metal to say to what extent gas has played a part in its formation. If, however, the metal is allowed to solidify under reduced pressure the effects of gas are exaggerated and one can estimate whether it is likely to play an important part in a casting solidifying under normal atmospheric pressure.

The possibility that porosity in magnesium-base alloys might be mainly due to gas given off from the metal was one of the first points to be investigated. An outline of the experimental work on this subject is given below.

1. *Test for the Presence of Gas.*—The test used in this work is illustrated in Fig. 8. A sample of the molten metal is scooped out of the pot into a small, thin-walled iron crucible, which is held in molten metal long enough to reach the same temperature as the melt. The crucible is then transferred to a vessel (with a glass window for observation) which is connected to a large reservoir which has previously been pumped out to a low pressure. On connecting the evacuated reservoir with the vessel in which the crucible is placed, the pressure falls to about 60 mm.

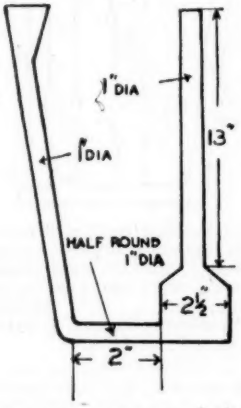

FIG. 1(*d*).—BOTTOM-RUN BOTTOM-FED BAR POURED AT CONTROLLED RATE THROUGH A BUSH.

of mercury. The metal is carefully observed during solidification, and when the sample has solidified it is cut up and examined if necessary. If the metal contains gas, bubbles of gas can be seen rising to the surface, while the metal solidifies, and the small ingot, when solid, shows blowholes, as illustrated in Fig. 9.

2. *Experimental Work.*—The appropriate gas was bubbled through the molten metal for varying periods before casting. Some tests were made using sulphur

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dioxide, carbon dioxide and carbon monoxide, but most of the work was done with hydrogen. A magnesium 7 per cent. aluminium alloy was used, and the following test castings made:—

DTD bars (Fig. 1 (*a*)) including some with 1½ in. dia. head. Up-run bars, but without a feeder head, and 1 in. dia. runner, 11 in. long and 1 in. dia. (Fig. 1 (*c*)).

3. *Results.*—No gas unsoundness was found after treatment with sulphur dioxide, carbon dioxide and carbon monoxide, although considerable drossing occurred on treatment with the oxides of carbon.

Melts made from virgin materials or from scrap which had only been in store for a short time under reasonably good storage conditions gave only slightly

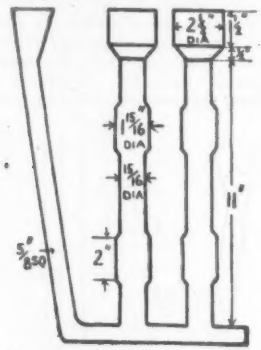

FIG. 1(*e*).—BOTTOM-RUN ROUND- OR SQUARE-SECTION BULGED BARS. SIMILAR BARS WERE MADE WITH NO FEEDER AT TOP, BUT A 1-IN. SQUARE DOWNGATE, AND POURED THROUGH A BUSH.

gassy melts. Metal which had been in store for some time, particularly that which had corroded, was gassy, but gas could be driven off by heating the metal to a temperature of about 350 deg. C. for 16 hrs. before melting, and could also be removed by allowing the molten metal to solidify, whereupon all the gas was given off, and then remelting. This procedure, well known in ordinary foundry practice, is known as pre-solidification. Gas could also be removed by chlorine treatment. It was found, however, that some porosity developed in the castings made in the top poured bars with small heads and in up-run 11-in. bars even when the melt was shown by the test described above to be substantially free from gas, but no porosity was found in "gas-free" metal cast in DTD bars (Fig. 1 (*a*)).

When hydrogen was introduced into the metal before casting some porosity was found in the DTD bars, and the amount of porosity in the other bars increased with a corresponding decrease in strength. As more hydrogen was introduced into the metal, so the amount of porosity in all the bars, increased and the strength decreased. The form of the porosity was, however, not altered by the presence of gas.

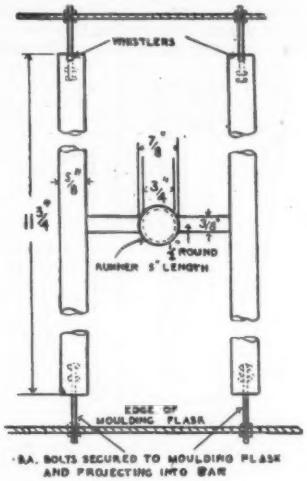

FIG. 1(*f*).—HOT-TEAR TEST CASTING.

4. *Possible Gas Pick-up from the Mould.*—The above tests were carried out on the assumption that the only gas given off on solidification would be that gas dissolved in the molten metal before casting. Recent work by the Association, however, has shown that many non-ferrous metals pick up hydrogen by reaction with moisture present in sand moulds, and

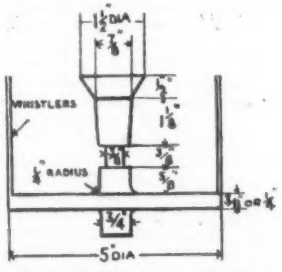

FIG. 1(*g*).—PRESSURE-DISC CASTING. RESTRICTED FEEDING INTO BOSS.

even metal which before casting was shown to be free from gas sometimes gave porous sand castings.

A few tests were made to see if magnesium-base alloys picked up gas from moulds. Some castings were made in the normal sand mixture, some using Red Mansfield sand, uninhibited and partially dried by heating for an hour at 100 deg. C., and others in Red Mansfield sand, uninhibited but thoroughly baked at 900 deg. C. (This high-temperature baking had been found necessary in other work to eliminate gas pick-up with phosphor bronze.*) The metal burnt in the partially dried Mansfield sand, and a great deal

FIG. 2.—A TYPICAL SHALLOW LAYER OF POROSITY IN A SAND CASTING (PARTIALLY SOLUTION HEAT-TREATED 93/7 MG-AL). × 40.

of porosity, which was of the usual layer form, was found in the bars. No porosity was, however, found in bars cast in the inhibited green sand or in the Mansfield sand baked at 900 deg. C., although in the latter there was a good deal of penetration of the metal into the sand.

These tests showed that magnesium-base alloys can absorb gas from wet sand moulds, although the presence of sulphur in the sand appeared to be sufficient to prevent appreciable gas pick-up. Even in inhibited moulds, however, it is possible that some gas pick-up may occur by reaction between the metal and moisture in the mould, particularly in over-heated parts. Fractures through runners and ingates are often badly discoloured in the outer layers, suggesting some reaction with the mould atmosphere.

5. *Conclusions.*—(1) Gas is not the primary cause of porosity in magnesium castings, since porosity has been found to develop in material which has been tested and shown to be free from gas liable to be evolved on solidification and when precautions were taken to avoid regassing in the mould.

(2) The presence of gas in magnesium-base alloys causes a marked increase in the amount of microporosity in the casting and does not alter its characteristic form, *i.e.*, layers of porosity in sand castings.

(3) Gas in magnesium alloys may arise in practice from corroded metal. It is assumed that the corrosion products carry with them considerable quantities of moisture which react with the metal when molten, introducing hydrogen. The danger can be minimised by storing ingot metal and scrap in dry conditions or by heating the metal long enough to dry off moisture from its surface before charging.

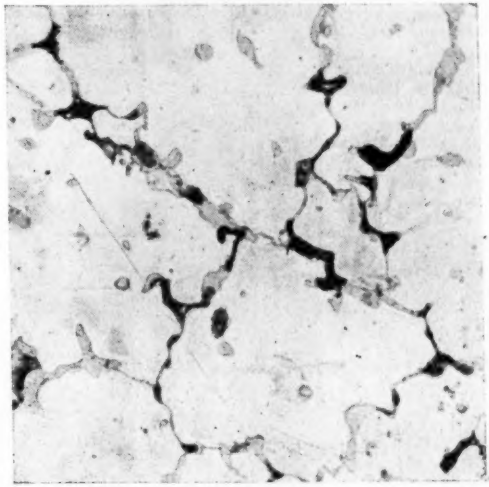

FIG. 3.—SHOWING INTERDENDRITIC FISSURES. × 250.

(4) Gas can be easily removed by pre-solidification, *i.e.*, by allowing the metal to solidify and remelting.

Effect of Alloy Constitution

It is well known in the trade that certain magnesium alloys are more prone to microporosity than others. This is not surprising, since it is well known that the form and amount of porosity in other non-ferrous metal castings depend on their constitution. One of the most important factors governing distribution of porosity is the freezing range of the metal, *i.e.*, the temperature range through which the alloy solidifies. Pure metal and eutectic alloys have no freezing range, but most alloys solidify over an appreciable temperature range. In a simple alloy system, such as magnesium-aluminium, the freezing range can

* Baker, Child and Glaisher, J.Inst. Metals, 1944, 70, 373.

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be altered by altering the proportion of the two alloying constituents.

In addition to the freezing range of the material the relative proportion of the metal which solidifies at different temperatures is important. For instance, in some alloys nearly all the metal solidifies at quite a high temperature and a small amount of liquid remains at the end, and does not solidify until a much lower temperature. In others a large proportion solidifies at the lowest temperature. In general, the way in which an alloy solidifies determines the form and distribution of the shrinkage porosity, which is bound to occur unless the casting is completely fed.

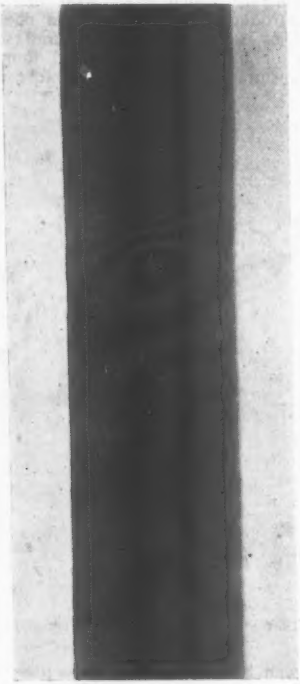

FIG. 4.—LAYER POROSITY SHOWN BY X-RAYS.

1. *Experimental Work.*—To study the effect of constitutional change the magnesium-aluminium system was used and alloys were made containing 2.5, 5, 10, 20 and 32 per cent. aluminium, with freezing ranges varying from 200 deg. C. to 0 deg. C. respectively. It should be kept in mind that the freezing ranges of the alloys are not necessarily those given by the equilibrium diagram, since solidification in a sand casting does not take place under equilibrium conditions.

In this work some of the alloy melts were not super-heated, so that a comparison was made between castings with different grain size. It should be noted, however, that even in the castings described as coarse-grained the grain size was smaller than that normally found in most other commercial casting alloys, including aluminium alloys. Test-bars used included DTD bars (Fig. 1 (*a*)), up-run bars 12 in. long (Fig. 1 (*c*)), disc castings Fig. 1 (*g*)), and hot-tear tests (Fig. 1 (*f*)).

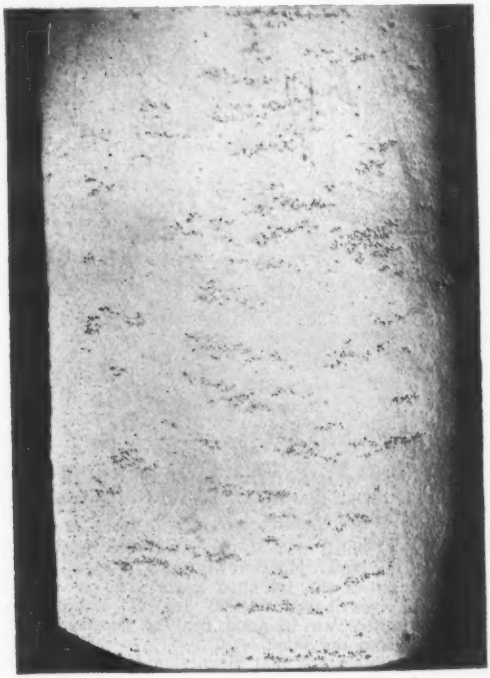

FIG. 5.—LAYERS OF POROSITY IN A MODERATELY UNSOUND SAND CASTING. × 2.5.

2. *Results.*—The results obtained showed that the amount of porosity, as judged by density measurements, did not vary very much with the constitution of the alloy and microporosity was liable to develop in any magnesium-base alloy which solidifies over an appreciable freezing range and which is not properly fed. X-ray examination showed typical layers of porosity in both the fine and coarser grained castings,

but the eutectic alloy in each case showed secondary pipe with no layers of porosity. In the 20 per cent. alloy also the porosity tended to concentrate in the centre and was intermediate between typical layer porosity shown by the other alloys and the secondary pipe shown by the eutectic alloy. The eutectic alloy was extremely brittle and the tensile properties of the 20 per cent. alloy were, in general, rather poor. There was little to choose, however, between the properties of the other alloys in the coarser-grained castings, but in the fine-grained super-heated castings the maximum tensile strength was obtained with the 5 per cent. alloy, and in each case was higher than the corresponding strength with the coarser-grained material. This applied both to the DTD bars and the up-run bars.

Leakage

None of the fine-grained disc castings leaked in the unmachined condition, though some leaked on machining. The pressure discs made in the coarse-grained material were much more liable to leak, however, and in some cases showed cracks round the boss. The finer-grained castings usually showed surface shrinks rather than cracks. The behaviour in the pressure-disc test was explained by the results from the hot-tear test, which showed more failures in the coarser than in the fine-grained material. With a fine-grained material the surface of the casting during solidification consists of a large number of very small crystals suspended in a liquid, and this tends to collapse as a whole as the casting shrinks. With a coarser-grained material, however, there is a greater tendency for cracks to form between the grains while the material is solidifying, because the larger crystals rapidly form a coherent mass which cannot collapse as a whole.

Poor resistance to pressure tightness and to hot tearing to some extent therefore go hand in hand, and are controlled, at least in part, by the grain size of the casting. With comparable grain size, the alloys of low aluminium content (*e.g.*, 2.5 and 5 per cent.) were more prone to hot-tear and to give defective disc castings than those of higher aluminium content (*e.g.*, 10 and 20 per cent.) and this can be explained on similar lines. In alloys of low aluminium content, most of the metal freezes in the upper part of the freezing range and the interlocking crystals formed are surrounded by thin films of low melting point metal. The contraction of the primary crystals during cooling in the lower part of the freezing range tends to pull them apart and produce hot tears, the intercrystalline films of liquid having negligible strength. In alloys of higher aluminium content, there is a relatively large proportion of liquid metal remaining liquid down to the solidus temperature and the contraction of the primary crystals is accommodated by feeding of this eutectic liquid or, in some cases, by feeding of the whole mass of small primaries and eutectic.

(*To be continued.*)

FIG. 6.—"INTENSE CONCENTRATION" OF MICROPOROSITY IN A BADLY-FED SAND CASTING. × 2.5.

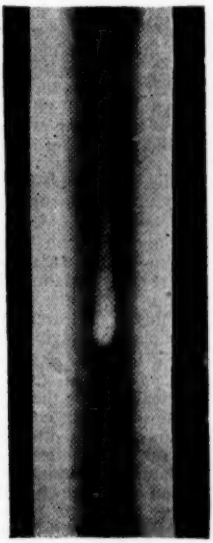

FIG. 7. — SECONDARY PIPE IN A EUTECTIC MAGNESIUM-ALUMINIUM ALLOY. × 1.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

"STEEL FOUNDRIES AT THE CROSS ROADS"

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your leading article, "Steel Foundries at the Cross Roads," states the case for close co-operation with other foundry interests, and if there were no other factors your argument would be unanswerable. The case for the other side, speaking from the technical point of view only, is less obvious, but more weighty. The majority of the more serious defects that may occur in a steel casting, such as shrinkage cavities, gas holes, short runs, hot tears, sand penetration, burning on, and the rest, are directly due to the characteristic behaviour in freezing and cooling of that complex metal steel, and, for the most part, do not occur to any important degree in founding most other commercial metals.

Speaking broadly, the difficulty of steel compared, say, with iron founding, lies in the fact that the melting temperature is much higher, the contraction on freezing much greater, and the freezing range much wider. In addition, steel freezes out into a variety of solutions and crystalline forms at different temperatures.

The experienced practical man has had undisputed control to a later date in the steel foundry than in almost any other industry because of the difficulty and complexity of the scientific principles involved. Some may think that that state of things should have continued, but it is too late now, and technical control has already advanced so far in many foundries that retrogression is unthinkable. Nevertheless, the gaps in scientific knowledge necessary to enable the technician to control operations efficiently are deplorable, and taking the long view, constant endeavour in higher research is essential if these gaps are to be filled and full progress ensured.

Most of the serious problems of the steel industry in connection with the production of steel ingots occur in almost the same form as in castings, so that it is of great importance that the steel castings industry should be in the closest touch with the enormous amount of research work carried out on the basic principles underlying the production of good ingots.

Real research work may take years before it bears fruit, and even then is not always recognised by practical men as the real origin of improved technique. In the meantime, co-operative research at a lower level and interchange of information both in steel questions and on the points you mention, are more important for immediate results. They are indeed being actively carried on by the committee of which I have the honour to be chairman. Collaboration with the foundry industry in general should also be actively pursued, but calls for no very formal and close association.

Research is rather a different matter, since the scientist, it must be admitted, tends to soar above the clouds, and it is only by pulling him down to earth occasionally through close association, that he can be kept within sight, and the fullest use made of his work. In conclusion, I wish to add that the views expressed are my own, and that my letter has not been read by any of the other members of the committee.

Yours, etc.,

BASIL GRAY,
(Chairman, B.S.F.A. Technical Committee).
English Steel Corporation, Limited,
Vickers Works, Sheffield.

"OUR FIVE-YEAR PLAN"

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have read with much interest your leading article "Our Five-year Plan," published in your issue of October 11. The note of unity which runs through it is, to my mind, the fundamental issue of the problems confronting the industry. Many of the vital factors contributing to the victory of the United Nations, notably "Fido," "Pluto," the Mulberry Harbour, etc., which at the outset were regarded as impossible, were brought into being by unity of purpose, motivated by that which was at stake.

At the present time the industry is confronted by two major problems, as stated in the first and second points of your plan. The vital question is: Can the present generation of foundrymen solve these problems which are fundamental to its future? The answer will be given within the next few years, and will depend upon individual effort, and unity of purpose among all who have an interest in the industry's future.

The foundry industry's contribution to the war effort amply indicates that there exists among the executive and technical personnel those with determination and ability to meet and solve its problems. During this period these problems have of necessity been those of production; and now, in the period of transition, there exists the urgent problem of recruiting and training. Your American contemporary, "The Foundry," in their September issue, have again stressed in the leading article the importance of matching man-power with machine.

While unity is of national importance, I regard it as vital among directorates and executives, for without this the work of the national bodies cannot be fully exploited. The foundry industry has served the nation and the community abundantly, and with the united effort of all grades of personnel, can serve to even greater capacity.

Yours, etc.,

R. F. COATES.

94, Brunswick Road, Ipswich.

INDEX TO VOLUME LXXVI

The index to Vol. LXXVI (May-August, 1945) is now ready, and may be obtained on application to the Publisher, THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

METHODS OF PRODUCTION IN THE POST-WAR FOUNDRY*

By WILLIAM PEACOCK

[ABSTRACT]

In the foundry industry, castings have to meet increased competition with other materials and methods of manufacture. Prefabrication of steel pressings electrically welded will be a strong opponent, particularly in heavy castings; plastics in opposition to small castings, and asbestos cement to replace light castings, such as gutters, pipes, etc. However, the foundry industry can succeed if managements organise and keep to the forefront in modern methods. They must tackle problems as well as the light alloys foundries have done in wartime to keep the vital aircraft industry well supplied with castings, in alloys and under conditions definitely unique to a foundryman prior to the war. The foundry can offer goods of almost any design and in any metal, and of greater rigidity than steel pressings.

For production, the mechanised foundry can outstrip its competitors if it is planned scientifically. The patternshop causes the foundry the chief overhead charge, but this can be reduced in repetition foundries by the adoption of master patterns and coreboxes so that the patterns can be made in metal in order to obtain a greater degree of accuracy and a safeguard against wear, etc., and replacements can be readily executed, thus avoiding bottlenecks in production. The advantage of the foundry is that the amount of waste in an economically run foundry compares very favourably with other industries.

Coreshop Layout

The layout of a foundry is a very important factor, so as to ensure the maximum of safety, elimination of unnecessary handling and maximum use of floor space available. A start should be made with the coreshop, which would have the sand-drying and sand-mixing plant at the extreme end of the shop, and the sand transported to the operators mechanically or man-handled according to the size of the shop. There should be a conveyor belt running down the middle of the coreshop, with benches and core blowers or round core machines at either side of the belt. It is advisable to have one or two benches allotted for the bending and preparing of core-iron wires, so that the coremaker can utilise his time making cores which gives the operator greater speed and efficiency and also gets the most out of the equipment in use. At the other end of the conveyor belt would be the core stove. If the work be small or medium, a vertical drier would be preferred. These stoves are very economical to operate; they do not require a large amount of fuel and do not take up much floor space. After the cores leave the stove a table or stand should be arranged so as to receive them, prior to being dressed off and handed over to core inspection to be gauged and jigged. The chief function of the core inspection would be to store cores and hand them over to the foundry all ready for the moulds.

Moulding Bays

The foundry is the next department to lay out, and this again depends on the class of work undertaken; if a continuous casting method is to be adopted, the main point is to eliminate as much handling as possible. Also, another point is to plan so that each operation can be carried out without unnecessary hold-ups. Also, it would be important to make castings of the same category on each unit of mechanisation. A circular or oval track is preferred, where possible, with the moulding machines arranged in pairs in the centre, with a small track in between each pair of machines to the outer track so that, when the drag and top are made, they can be arranged on the small track, for coring up, finishing and closing. Then the finished moulds would be slid on to the main track for pouring, opening, etc. Box parts should be arranged after opening so as to be stacked around their respective machines. The sands would be knocked down a grating on to an underground belt and transported to the sand mills. There the sand would be separated from the scrap and aerated and milled, and then conveyed to the hoppers feeding the moulding machines.

It is advisable to take a spot check of each type of casting every few hours or so, so as to remedy any faults before large numbers of castings are made, so avoiding unnecessarily high scrap percentages. Afterwards the castings would be shot-blasted prior to trimming. The trimming shop should be situated as near to the knock-out end of the track in the foundry as possible. After trimming, the castings should be passed by a castings inspector who knows the customer's specifications and to save unnecessary transit and machining of faulty and defective castings. It is advisable also to keep the scrap where it should be kept—*id est*, in the foundry—so that engineers cannot draw comparisons on that account with other materials and methods of production.

It is advisable to have a small experimental and jobbing foundry attached so that the correct moulding technique can be found before going into full production. Jobs can be roughly timed and estimated for divisional labour without holding up production. Shop tackle can be made, whilst it is also a useful training ground for apprentices and trainees.

Maintenance

Maintenance is an item often badly neglected in the foundry. All tackle and machinery should be kept in good shape and repair. Too often does one find bent coreplates, boxes with faulty pins, boxes cracked, sand mills badly caked up with hard sand, core stoves not giving the maximum efficiency; also the use of improvised tackle, where it would be cheaper and more economical to make or buy the proper article. All these items require immediate

* Joint winning entry for the S. W. Wise memorial prize, organised by the West Riding of Yorkshire branch of the Institute of British Foundrymen.

Methods of Production

attention, as they tend to retard production, promote faulty workmanship, and can be a source of danger and worry to the operator. Another point is the skilful use of lighting. Badly spaced lights throw awkward shadows and a moulder is badly handicapped when he is gauging or finishing a mould. Badly leaking roofs can cause a large amount of damage in a foundry; these should be remedied at once—not just relying on corrugated sheets to cover moulds, etc. Maintenance is just as important in a foundry as in a machine shop; prompt attention can save many production hours. Good harmony is essential between patternshop and foundry and between foundry and machine shop. It is up to the patternmaker to avoid unnecessary loose pieces and awkward corners in coreboxes and patterns, when perhaps a small additional core may save a moulder's time considerably. Core and mould gauges should be constantly checked and patterns and coreboxes kept in good repair.

Good co-operation between the foundry and the engineer is vital. Many valuable man-hours can be saved through a little foresight between foundry and engineer. The foundryman should be well acquainted with the ultimate function of the casting concerned so as to offer alternative suggestions in the design of the casting and in order to eliminate any unnecessary obstacles and risks for the foundry and many instances regarding the saving of weight which may be trifling in comparison to the additional work placed on the foundry. The foundryman should have a voice in the design and construction of coreboxes and patterns. Many expensive patternmaking hours can be wasted through the patterns not being designed to the foundry's requirements.

Production Level

Over-production and under-production are other problems to the foundry. If an engineer requires, say, 100 castings per week, it is up to the foundry to maintain this and not work below or over the amount required, at the same time making due allowances for scrap percentages. Under-production can cause bottlenecks in the machine shop and may cause machines to stand idle, whereas over-production can result in being taxed for storage with a resultant shortage of work in the foundry at a later date. Good planning can keep a foundry fully employed economically, as the overhead charges are almost the same whether a foundry is operated to full or part capacity.

There are great possibilities in the foundry if the foundryman makes the best use of modern science and rejects the old-fashioned prejudice against any new ideas, which has fettered the industry so long and allowed other industries to trespass on its preserves.

ACCORDING TO "Metals and Alloys," magnesium-cerium alloys containing 4 to 6 per cent. cerium and 2 per cent. magnesium are excellent for elevated temperature applications, such as pistons, for which the Germans found them highly useful during the war.

NON-FERROUS SCRAP METAL PRICES

MINISTRY OF SUPPLY SALES

The Minister of Supply has issued the following list of prices of non-ferrous scrap metals. These are prices at Ministry of Supply depots at which the Minister is prepared to effect a sale to a buyer subject to having sufficient material of that particular quality available at a convenient depot at any particular time. The list relates to the period of three months from September 11 to December 31, and shows no change from that published for the preceding period. It is published without prejudice or commitment. Without notice the schedule of materials may be amended in the light of changing circumstances and prices may be altered in accordance with market conditions, production costs and other factors. Any inquiries should be addressed in the first instance to the Directorate of Non-ferrous Metals Control (Scrap Disposals Department), Euston House, London, N.W.1. Prices are all per ton, ex works.

Copper.—Copper, clean, untinned, cut up, £56 10s.; bright untinned copper wire, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; shell band scrap (other than turnings), £56 10s.; copper firebox plates, cut up, £57 10s.; copper turnings (including shell-band turnings), £48; braziery copper, £53 10s.; cupro-nickel scrap, 80/20, webbing, £75 10s.; cupro-nickel scrap, defective cups and envelopes before filling, £70 10s.

Lead.—Lead scrap, £25 15s.

Zinc.—Zinc scrap, £24.

Brass.—Brass ingots, £51; S.A.A. webbing, £48 10s.; defective cups and cases, £47 10s.; cut-offs and trimmings, £42 10s.; muffled cases, Grade A (electrically muffled), £47; muffled cases, Grade B (electrically muffled), £45; turnings, loose, £37; turnings, masticated, £42; fired cases, £47; fired Q.F. cases, £48 17s. 6d.; Q.F. webbing, £49; Q.F. cut-offs and trimmings, £47 10s.; Q.F. defective cups and cases, £49; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; 70/30 metallics, £34; 60/40 rod swarf, £30 10s.; 60/40 metallics, £27; process and manufacturing scrap containing 62 per cent. and up to 68 per cent. copper, £43 10s.; process and manufacturing scrap containing over 58 per cent. and up to 62 per cent., £38 10s.; broken-down fuse scrap, 60/40, £38; 85/15 gilding metal webbing, £52 10s.; 85/15 defective gilding metal cups and envelopes before filling, £50 10s.; 90/10 gilding metal webbing, £53 10s.; 90/10 gilding metal defective cups and envelopes before filling, £51 10s.; cap metal webbing, 95/5, £54 10s.

Gunmetal.—Scrap, Admiralty, 88/10/2, £77; scrap, Admiralty, £72 10s.

Nickel Silver.—Process and manufacturing scrap, 10 per cent., £50; 15 per cent., £56; 18 per cent., £60; 20 per cent., £63.

UNITED KINGDOM consumption of cadmium in the first six months of 1945 totalled 235 tons, the plating trades absorbing 104 tons, alloys 51 tons, batteries 60 tons and miscellaneous trades 20 tons.

STEEL PRODUCTION IN INDIA

CAPACITY ALMOST DOUBLED

India's steel-producing capacity has been almost doubled during the war. This and other interesting information was given by Sir Biren Mookerjee, the chairman, at the annual meeting of the Steel Corporation of Bengal, Limited, held last month in Calcutta.

Sir Biren said that the Corporation produced steel for the first time on November 10, 1939, and long before they got out of their teething troubles the war situation had taken a serious turn and they were asked by the Government to produce other types and qualities of steel than those they would normally have made. This meant extensions to existing plant in some cases and completely new plant in others. Hardly had they completed these extensions and were getting a reasonable production than conditions changed further, and again more pressure was put on them for the production not only of more steel, but also of different qualities. In other words, they were asked to trot before they knew how to walk, and before they could trot decently they were called upon to gallop. The chairman added that when the extensions now in course of completion came into operation, they might expect their production of steel to be more than doubled as compared with the original layout. Since the commencement of the company more than 700,000 tons of steel had been produced. In addition to an extensive range of mild-steel structural sections, bars, and black and galvanised sheets, the works had delivered large tonnages of shell steel, spring steel, and high-carbon tool steel. Heavy rails had been supplied to the Indian railways as well as to the Army for strategic lines. Light rails had been supplied in large quantities for military use. The works were equipped to roll and finish heavy rails in lengths more than double those so far produced in India. It was hoped to supply to the railways in the near future rails in 90-ft. lengths. In the early days of the war the works rolled and delivered some beams 96 ft. long, which were required for a special purpose.

U.K. CONSUMPTION OF ANTIMONY

United Kingdom consumption of antimony metal and compounds (in terms of antimony metal), in the first six months of 1945 totalled 2,613 tons. Consumption by main trades was as follows:—

Antimonial lead, 1,180 tons; bearings, 251 tons; fireproofing camouflage scrim, 23 tons; other oxides and compounds, 677 tons; miscellaneous uses, 482 tons.

The above figures exclude the consumption of antimony in scrap, which is as follows:—For antimonial lead, 803 tons; all other purposes, 289 tons; total consumption in scrap, 1,092 tons.

THE ENGINEERING INDUSTRIES ASSOCIATION have sent a strong protest to the Government against the calling up of toolmakers and other young technicians needed for the re-equipment of industry.

REGIONAL BOARDS FOR INDUSTRY

ADVICE TO GOVERNMENT DEPARTMENTS

It is announced by the Board of Trade that as part of the department's plans for the reconversion of industry the Government has decided to retain the regional boards set up during the war to assist in making the best use of all productive resources for munitions production. In future the boards will exercise their activities over the whole field of industry, but will be strictly advisory in character. They will be renamed "Regional Boards for Industry" and will advise Ministers on industrial conditions within the regions and the steps necessary to bring regional resources in productive capacity or labour into fuller use. They will keep local industry advised of Government industrial policy and headquarters informed of the views of local industry. They will also keep in close touch with other committees in the region whose work may affect industrial interests.

The chairmen have been selected from industrialists, trade unionists, and experienced men of standing in the region. Chairmen and industrial representatives will hold office for three years. The industrial representatives will be appointed by the President of the Board of Trade, in consultation with the British Employers' Confederation, the Federation of British Industries, and the Trades Union Congress.

The National Production Advisory Council on Industry has also been re-established on the basis of six representatives each of the Trades Union Congress and the national employers' organisations, together with the chairman of each regional board. The newly constituted council is as follows:—

Representing the British Employers' Confederation and the F.B.I. jointly: Lieut.-Col. Lord Dudley Gordon, Sir Clive Baillieu, Sir Frank Platt, Sir Alexander Ramsay, Sir John Forbes Watson, and Mr. Andrew K. McCosh.

Representing the Trades Union Congress: Sir Mark Hodgson, Mr. H. N. Harrison, Mr. Jack Tanner, Mr. A. Deakin, Mr. A. Roberts, and Mr. Andrew Conley.

WEST OF SCOTLAND IRON AND STEEL INSTITUTE

In view of the death of Mr. D. A. MacCallum, the former secretary, the following changes have been made:—(*a*) The Library has been moved to 39, Elmbank Crescent, Glasgow, C.2, and is now housed in the building of the Institution of Engineers and Shipbuilders in Scotland. By agreement with that Institution, members of the West of Scotland Iron and Steel Institute and of the Institution of Engineers and Shipbuilders now have the privilege of using each other's Libraries. (*b*) The editing of the Institute Journal has been undertaken by Professor R. Hay, B.Sc., Ph.D., The Royal Technical College, Glasgow, and all correspondence on that subject should be addressed to Professor Hay. (*c*) Correspondence on all other matters relating to the Institute should now be addressed to the Secretary and Honorary Treasurer, Mr. P. W. Thomas, B.Sc. (Eng.), 39, Elmbank Crescent, Glasgow, C.2.

NEWS IN BRIEF

ANFIELD ENGINEERING COMPANY, LIMITED, is being wound up voluntarily. Mr. T. Alan Gott, 15, Deansgate, Blackpool, is the liquidator.

WALLWORK GEARS, LIMITED, announce that the address of their foundry equipment and mechanical handling department, as from November 1, will be 157, Victoria Street, London, S.W.1.

THE TELEGRAPHIC ADDRESS of the temporary head office of the British Aluminium Company, Limited, at Salisbury House, London Wall, London, E.C.2, has been changed to Britalumin Avenue, London.

MR. TOM LOWE, Divisional Organiser of the National Union of Foundry Workers, is among those taking part in a programme entitled "Slacking or Sacking," which is to be broadcast in the Midland and Welsh Home Services to-morrow evening (Friday) at 7 p.m. The broadcast is a discussion in the "Midland Parliament" series and will deal with the future of discipline in industry.

L. STERNE & COMPANY, LIMITED, Crown Ironworks, Glasgow, who have been manufacturing refrigerating plant for 60 years, are proposing, in conjunction with Scottish Industrial Estates, to build a further factory at Hillington to develop and expand the production of domestic cabinets, ice-cream cabinets, frosted food plant, and other small refrigerating plant. It is hoped to get into production next summer.

THE PRESIDENT OF THE BOARD OF TRADE, Sir Stafford Cripps, at a Press conference after his statement in the House of Commons on the functions of the working parties for the cotton, pottery, hosiery, furniture, and boot and shoe industries, gave further details of the scheme. He explained that while iron, steel, and engineering would not come under it, other industries besides those already announced would be dealt with in a similar way.

IT IS ANNOUNCED that Col. W. C. Devereux, former chairman and managing director of High Duty Alloys, Limited, is to take control of the Warwick Aviation Company, Limited. Considerable extensions to the existing factory at Warwick are envisaged, and it is estimated that employment will eventually be found for 2,000 people. It is proposed to embark upon a programme of work which will include the manufacture of light-alloy boats and a wide range of domestic articles.

ALLIED IRONFOUNDERS (IRELAND), LIMITED, have issued a circular to their preference shareholders in which the directors outline a proposal for the payment of two years' interest on the preference capital in full satisfaction for all arrears of dividends due thereon. The company was registered in Dublin in March, 1936, but no dividends have yet been paid on the preference capital, which is a cumulative issue. According to the report for the year ended June 30, 1944, profits amounted to £9,457, while the debit balance of £9,635 was reduced to £2,478. The £1 preference shares, which carry 6 per cent. cumulative interest, recently touched 29s. each on the Dublin Stock Exchange. This month, however, they were being quoted at 27s. The directors propose to summon an extraordinary meeting in Dublin shortly, at which they will put forward their plans to the shareholders.

RUSTON & HORNSBY, LIMITED, have sold £275,000 nominal of their residual £300,000 holdings of Ransomes, Sims & Jefferies ordinary stock, £200,000 of this stock, out of a total of £500,000, having previously been sold in 1940. During the 26 years since the Ransomes' stockholding was originally acquired, Ruston & Hornsby have concentrated their own manufacturing activities on the production of oil engines, oil locomotives, boiler works, and general engineering products, and have thereby gradually become less directly interested in the manufacture of agricultural implements in which they were formerly engaged. The Ruston board now consider that their financial resources should, as far as possible, be employed in furthering their oil engine and general engineering business. The disposal of the Ransomes, Sims & Jefferies ordinary stock now announced is in conformity with this policy, although the directorship of the two companies is undisturbed.

IRON AND STEEL PRICES

There has been no major alteration in steel prices since the beginning of 1941 and undoubtedly this has been an outstanding factor contributing to price stability in general during the war period. The Board of Trade index figures show that the average increase in iron and steel prices since 1938 has been 36 per cent., compared with 100 per cent. increase in coal prices and an increase of 135 per cent. in coke. The general wholesale price index shows an increase of almost 70 per cent., against which the increase in steel again is moderate.

Taking 1938 figures as representing 100, general prices in June, 1945, showed a figure of 168.7, iron and steel 136.1 and coal 197.8. Increases were much steeper during the last war. Taking 1913 as equalling 100, general prices in 1920 showed an index figure of 316.6, iron and steel 347.9, and coal 340.0. In this war the efforts to restrain inflationary price increases have been far more successful.

How long can the present position be maintained? Comments in the reports of the Public Accounts Committee and other Government reports indicate that one of the main factors in keeping down steel prices has been the use of the Ministry of Supply central fund. They further indicate that the fund was running into deficit by 1943 and was beginning to draw on surpluses for past years. Since early in 1944, there have been further increases in coal prices which total 10s. 6d. per ton. Since coal is the largest single cost item in steel production this almost certainly has put the steel price position out of balance. To the extent that prices of iron and steel are kept at their current levels with the help of the Central Fund, they are artificial. Withdrawal of the present arrangements would make current quotations uneconomic and some adjustment would obviously have to be made. There are indications that changes in prices will not be long delayed.

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STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3¾ inches

(at notch 2½ inches).

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THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

SCOTTISH ENGINEERING STUDENTS

Sir Harold E. Yarrow, Bt., C.B.E., delivered his presidential address at the first meeting of the newly-formed Scottish Engineering Students' Association, held at the Institution of Engineers and Shipbuilders, Glasgow, about 100 younger members of various Scottish technical institutions and societies being present. Mr. H. B. Sutherland, chairman of the Association, explained that it was backed financially by a number of prominent Scottish engineers and shipbuilders, of which Sir Harold was one. He emphasised, however, that complete freedom of action was being left to the students themselves to plan and organise their activities as they so wished.

The president felt that the Association could fulfil a very useful function by bringing young men in all branches of engineering together from time to time and by removing the objection that engineers keep all too often within their own "watertight compartments." He emphasised that there was no desire that the Association should interfere with the activities of the individual insitutions, and, to this end, only members of recognised technical institutions and societies were eligible for membership.

Mr. A. Ross Belch, 420, Sauchiehall Street, Glasgow, C.2, is hon. secretary of the Association.

IN PARLIAMENT

New Blast Furnaces

MR. A. EDWARDS asked the Minister of Supply and of Aircraft Production if he could give an assurance that the steel industry's plans to erect 18 new blast furnaces had been referred to the Blast-furnacemen's Association for their comments and co-operation in determining their location.

MR. WILMOT: The Iron and Steel Federation's long-term plans for development have not yet been submitted to the Government, but it is my intention that the views of organised labour in the industry shall be taken into account before they are approved.

Steel Industry Reorganisation

MR. A. EDWARDS asked the Minister of Supply and of Aircraft Production if any proposal had been made to the steel industry on the lines of the proposals made to the cotton industry for reorganisation.

MR. WILMOT: No. I do not consider this particular method would be suitable for application to the industry in question.

ETHYL SILICATE

In connection with the meeting which is to take place under the auspices of the London branch of the Institute of British Foundrymen on October 31, when there is to be a Paper and demonstration by Mr. C. Shaw and Mr. Noel Shaw as to the use of ethyl silicate in foundry practice, we give the following information. The process to be discussed relates to the production of precision castings in both ferrous and non-ferrous by a method which is a modern development of the original lost-wax process.

CRUCIBLE AND TOOL STEEL ASSOCIATION

The Crucible and Tool Steel Association has been formed in order to foster the commercial and technical interests of the crucible and tool steel trade. Hitherto the only association in the trade has been the old-established Crucible Steel Makers' Association, which, however, was formed only to deal with labour questions, wages, and working conditions. That Association remains in being, but its activities will be confined to labour matters, and commercial or technical questions will in the future be dealt with by the new body.

The first president of the Association is Mr. S. H. Letall (Watson, Saville & Company, Limited), and Mr. L. Chapman (William Jessop & Sons, Limited), together with Mr. W. Brazenall (Walter Spencer & Company, Limited), will represent the crucible and tool steel and the high-speed steel industries on the council of the Federation. The secretary is Mr. Charles E. Bell, with temporary offices at 59, Clarkehouse Road, Sheffield, 10.

OBITUARY

MR. FRANK ELLISS, formerly a director of William Elliss & Sons, Limited, ironfounders, Sheffield, has died at Morecambe, where he had lived in retirement for the past nine years. He was 82.

MR. JOHN WILLIAM RUSSELL, late managing director of Stewart M'Intyre & Company, Limited, engineers and contractors, Singapore, died in October, 1944, while a prisoner of the Japanese. His home was in Glasgow.

MR. DANIEL DUNLOP BLAIR died at Labuan, Borneo, on January 28, 1945, while a prisoner in Japanese hands. He was associated with Stewart M'Intyre & Company, Limited, engineers and contractors, of Singapore. His home was in Motherwell.

SEPTEMBER IRON AND STEEL PRODUCTION

The figures below show pig-iron and steel-ingot production (in tons) for September, 1945:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1st half 1945	133,900	6,963,000	231,600	12,043,000
July	134,800	7,010,000	213,800	11,118,000
August	125,200	6,512,000	186,100	9,676,000
September	139,500	7,255,000	240,700	12,517,000

CONSUMPTION OF MANGANESE METAL

United Kingdom consumption of manganese metal, including the manganese content of master alloys, totalled 278 tons in the first half of 1945, of which 164 tons was used for light alloys and 112 tons for copper alloys.